

WHAT IS CLAIMED IS:

1. A method of providing a controlled current to an electronic device, comprising:
producing a pulse-width modulation (PWM) signal to provide said current;
measuring an average of said current provided to the electronic device using a dual-slope integrator; and
setting a duty cycle of said pulse-width modulation signal based, at least in part, on said measuring.
2. The method of claim 1 wherein said measuring an average of said current comprises:
during a sampling interval, integrating a signal proportional to said current using said dual-slope integrator, said integrating resulting in an integrated signal;
determining a magnitude of said integrated signal; and
using said magnitude of said integrated signal and a length of said sampling interval to calculate a measured average current.
3. The method of claim 2 wherein said integrating comprises charging a capacitor from an initial level to a final level and wherein said determining a magnitude comprises calculating a time for discharging said capacitor at a known rate from said final level to said initial level.
4. The method of claim 2 wherein said sampling interval is a PWM period.
5. The method of claim 4 wherein said PWM period is a first PWM period, and wherein said determining a magnitude is performed during a second PWM period immediately following said first PWM period.
6. The method of claim 5 wherein said setting a duty cycle is effective in said pulse-width modulation signal during a third PWM period immediately following said second PWM period.

7. The method of claim 1 wherein said measuring an average of said current results in a measured average current and wherein said setting a duty cycle comprises:

comparing said measured average current to an input value representing a desired average current; and
regulating said duty cycle of said pulse-width modulation signal based on said comparing.

8. The method of claim 7 wherein said input value is a digital representation of an input voltage.

9. The method of claim 7 wherein said duty cycle is computed by scaling said input value by a multiplicative factor and adding an additive factor.

10. The method of claim 9 wherein said regulating comprises, if said comparing indicates that said measured average current is less than said desired average current, increasing the additive factor by a first fixed amount.

11. The method of claim 10 wherein said regulating further comprises, if said increasing the additive factor by a first fixed amount results in said additive factor exceeding a limit:

zeroing said additive factor; and
increasing said multiplicative factor by a second fixed amount.

12. The method of claim 9 wherein said regulating comprises, if said comparing indicates that said measured average current is greater than said desired average current, decreasing the additive factor by a first fixed amount.

13. The method of claim 12 wherein said regulating further comprises, if said decreasing the additive factor by a first fixed amount results in said additive factor falling below a limit:

zeroing said additive factor; and
decreasing said multiplicative factor by a second fixed amount.

14. The method of claim 1 wherein said setting a duty cycle comprises scaling an input value representing a desired average current by a multiplicative factor and adding an additive factor, said scaling and adding resulting in a calculated duty cycle.
15. The method of claim 14 wherein said scaling and adding are completed during a first PWM period and said calculated duty cycle is effective in said pulse-width modulation during a second PWM period immediately following said first PWM period.
16. A system for providing a controlled current to an electronic device, comprising:
a pulse-width modulation (PWM) signal generator for providing said current;
a dual-slope integrator for use in measuring an average current supplied to the electronic device, said measuring resulting in a measured average current; and
a duty cycle calculator for calculating a duty cycle of said pulse-width modulation based, at least in part, on said measured average current.
17. The system of claim 16 wherein said measuring an average current comprises:
during a sampling interval, integrating a signal proportional to said current using said dual-slope integrator, said integrating resulting in an integrated signal;
determining a magnitude of said integrated signal; and
using said magnitude of said integrated signal and a length of said sampling interval to calculate a measured average current.
18. The system of claim 17 wherein said sampling interval is a PWM period.
19. The system of claim 16 further comprising:
an error calculator for comparing said measured average current to an input value representing a desired average current and for calculating an error value based on said comparing.
20. The system of claim 19 wherein said input value is a digital representation of an input voltage.

21. The system of claim 19 wherein said duty cycle calculator calculates said duty cycle by scaling said input value by a scalar and adding an additive factor, said scaling and adding resulting in a calculated duty cycle.

22. The system of claim 21 wherein said scaling and adding are completed during a first PWM period and said calculated duty cycle is effective in said pulse-width modulation during a second PWM period immediately following said first PWM period.

23. The system of claim 21 wherein, if said error value indicates that said measured average current is less than said desired average current, said duty cycle calculator increases the additive factor by a first fixed amount.

24. The system of claim 23 wherein, if said additive factor exceeds a limit, said duty cycle calculator:

zeroes said additive factor; and

increases said multiplicative factor by a second fixed amount.

25. The system of claim 21 wherein, if said error value indicates that said measured average current is greater than said desired average current, said duty cycle calculator decreases the additive factor by a first fixed amount.

26. The method of claim 25 wherein, if said additive falls below a limit, said duty cycle calculator:

zeroes said additive factor; and

decreases said multiplicative factor by a second fixed amount.

27. The system of claim 16 wherein said duty cycle calculator calculates said duty cycle by scaling an input value representing a desired average current by a scalar and adding an additive factor.

28. The system of claim 27 wherein, if said input value is received during a first PWM period, said duty cycle calculator calculates said duty cycle for effectiveness in said pulse-

width modulation signal during a second PWM period, said second PWM period immediately following said first PWM period.

29. A computer-readable medium storing instructions which, when executed by a computing device in a system for providing a controlled current to an electronic device by way of a pulse-width modulation (PWM) signal, cause said computing device to:

- (a) calculate from measurements produced by a dual-slope integrator a measured average current supplied to the electronic device; and
- (b) set a duty cycle of said pulse-width modulation signal based, at least in part, on said measured average current.

30. The computer-readable medium of claim 29 wherein (a) comprises:

- determining a duration of de-integration of an integrated signal, said integrated signal having been integrated during a sampling interval by said dual-slope integrator from a signal proportional to the current provided to said electronic device; and
- using said duration and a length of said sampling interval to calculate said measured average current.

31. The computer-readable medium of claim 30 wherein said sampling interval is a PWM period.

32. The computer-readable medium of claim 29 wherein (b) comprises:

- comparing said measured average current to an input value representing a desired average current; and
- regulating said duty cycle of said pulse-width modulation signal based on said comparing.

33. The computer-readable medium of claim 32 wherein said input value is a digital representation of an input voltage.

34. The computer-readable medium of claim 32 wherein said duty cycle is computed by scaling said input value by a multiplicative factor and adding an additive factor.

35. The computer-readable medium of claim 34 wherein said regulating comprises, if said comparing indicates that said measured average current is less than said desired average current, increasing the additive factor by a first fixed amount.

36. The computer-readable medium of claim 35 wherein said regulating further comprises, if said increasing the additive factor by a first fixed amount results in said additive factor exceeding a limit:

zeroing said additive factor; and

increasing said multiplicative factor by a second fixed amount.

37. The computer-readable medium of claim 34 wherein said regulating comprises, if said comparing indicates that said measured average current is greater than said desired average current, decreasing the additive factor by a first fixed amount.

38. The computer-readable medium of claim 37 wherein said regulating further comprises, if said decreasing the additive factor by a first fixed amount results in said additive factor falling below a limit:

zeroing said additive factor; and

decreasing said multiplicative factor by a second fixed amount.

39. The computer-readable medium of claim 29 wherein (b) comprises scaling an input value representing a desired average current by a multiplicative factor and adding an additive factor, said scaling and adding resulting in a calculated duty cycle.

40. The computer-readable medium of claim 39 wherein said scaling and adding are completed during a first PWM period and said calculated duty cycle is effective in said pulse-width modulation during a second PWM period immediately following said first PWM period.